

REMARKS

Applicants thank Examiner Culbert for indicating that Claims 8-11, 13, and 16 are allowable. However, it is believed that Claim 1, and all claims dependent thereon, are allowable too. Applicants kindly request that the Examiner reconsider the outstanding rejections in view of the following remarks.

The rejection of any one of Claims 1-16 under 35 U.S.C. § 102(e), or in the alternative under 35 U.S.C. § 103(a), over the disclosure of U.S. Patent Application Publication 2003/0205552 (US '552) is respectfully traversed.

The rejections of Claims 7 and 15 under 35 U.S.C. § 103(a) over the combined disclosure of US '552 and either U.S. Patent No. 6,660,648 (US '648) or U.S. Patent No. 5,651,900 (US '900) are respectfully traversed.

It is noted that the disclosure of US '552 and WO 01/36321 (WO '321) belong to the same patent family. The Examiner's attention is directed to pages 4-6 of the present specification which discloses in some detail the method disclosed in WO '321, and thus, US '552. It is noted that the simplest embodiment disclosed in US '552 contains no less than 11 steps (see page 6, lines 5-6). Because the disclosure of US '552 discloses a method for preparing a biomimetic membrane containing no less than 11 steps, this method is very costly. Applicants also note that this method "leads to a membrane being obtained which is formed by the structural layer (polycrystalline silicon or Si₃N₄) and in which the wall of the pores that cross through it is not homogeneous and said wall is partially formed of the material of the structural layer and of the polysilicon of the 'plug' layer" (see specification text at page 6, lines 7-13). It is noted that an aspect of the method disclosed in US '552 is that an "etch stop layer" 22 is deposited on a substrate layer 20 which serves as the "base support" for the deposition of etchable material 24.

Because US '552 discloses a method in which an "etch stop layer" is deposited directly on the substrate layer, the etch stop layer becomes an integral part of the pre-fabricated biomimetic layer. For example, the Examiner's attention is directed to Fig. 8b (which is represented below) showing that a portion of the substrate layer is removed in order to expose the etch stop layer. In order to obtain the biomimetic layer without the etch stop layer, a subsequent step must be applied in order to liberate the openings of the pre-fabricated biomimetic layer (see Fig. 9b).

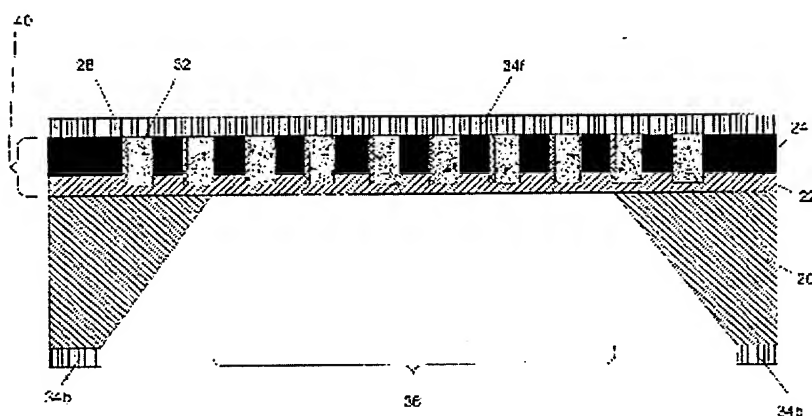


Fig. 8B

In order to provide the Examiner with an additional understanding of the differences between the presently claimed method and the method disclosed in US '552, Applicants direct the Examiner's attention to the following table which compares the steps of the method as defined in Claim 1 of the instant application with the steps of the method as disclosed in the detailed description and shown in Figures 1-9B of US '552. Please note that the left column of the table substantially corresponds to Figure 10 of US '552.

Method as disclosed in the detailed description and as shown in Figures 1-9B of US '552		Method as claimed in Claim 1 of the instant application	
Form an etch stop layer 22 on a substrate 20	STEP 50	Form a layer B on a substrate A	STEP a)
⇓		⇓	
Form a base layer 24 on etch stop layer 22	STEP 52	-----	
⇓		⇓	
Etch micrometer scale holes through the base layer 24 and into etch stop layer 22	STEP 54	Forming through holes within layer B, each hole having a wall made of the material of layer B and a bottom made of the material of substrate A	STEP b)
⇓		⇓	
Form a sacrificial base layer 28 on base layer 24 and the micrometer scale holes	STEP 56	-----	
⇓		⇓	
Pattern anchor points in sacrificial base layer 28	STEP 58	-----	
⇓		⇓	
Form a plug layer 32 on sacrificial base layer 28, on the anchor points and filling the micrometer scale holes	STEP 60	Form a layer C on layer B which closely hugs the wall and the bottom of the holes	STEP c)
⇓		⇓	
Planarize (to the level of base layer 24) and polish plug layer 32	STEP 62	Eliminate layer C from underlying layer B and, at the center of the holes, from underlying substrate A while leaving a residue of layer C on the wall of the holes	STEP d)
⇓		⇓	
Form protective layers 34b & 34f on both sides of the wafer	STEP 64	-----	
⇓		⇓	
Pattern and etch backside protective layer 34b and underlying substrate 20 to form an aperture	STEP 66	-----	
⇓		⇓	
Selectively release protective layers 34b & 34f	STEP 68	-----	
⇓		⇓	
Etch sacrificial base layer 28 and etch stop layer 22	STEP 70	Eliminate partially or totally substrate A for liberating at least the part of layer B in which are found the holes	STEP e)

As shown by the Table above, the method of the present invention differs from the method disclosed in US '552 in that:

1) Step 1) and step b) of the method of the invention are directed to:
depositing layer B on substrate A and
forming holes through layer B, but only within layer B, so as to obtain holes having a wall made of the material of layer B and a bottom made of the material of substrate A.

By contrast, steps 50, 52 and 54 of the method of US '552 are directed to:

depositing etch stop layer 22 on substrate 29;
depositing base layer 24 on etch stop layer 22; and
forming holes which completely penetrate base layer 24 but partially penetrate etch stop layer 22 so as to obtain holes having a wall made of the material of base layer 24 and a bottom made of the material of etch stop layer 22.

Since the bottom of the holes are made of the material of substrate A, it should be clear that the method of the present invention does not and cannot comprise any step equivalent to step 52 of the method of US '552 consisting in filing on the substrate a layer which is precisely intended to avoid the bottom of the holes to be formed by this substrate (see US '552 at page 3, para. 48).

2. Step c) of the method of the present invention is directed to depositing a layer C on layer B which closely hugs the wall and the bottom of the holes, which means that, on the one hand, the layer C is in contact with layer B and with substrate A, and, on the other hand, the layer C does not fill entirely the holes (see Figure 3 of the instant application).

By contrast, steps 56, 58 and 60 respectively are directed to:

depositing sacrificial base layer 28 on base layer 24 and within the holes;

patterning anchor points in sacrificial base layer 28; and

depositing plug layer 32 on sacrificial layer 28 and on the anchor points so as to completely filling the holes with said plug layer 32 (see Figure 6 of US '552).

As a result, plug layer 32 is in contact with etch layer 22, with the rests of sacrificial base layer 28 and with base layer 24 (at the anchor points), but in no case with substrate 20.

3. Step d) of the method of the present invention is directed to removing layer C from underlying layer B and, at the center of the holes, from underlying substrate A while leaving a residue of layer C on the wall of said holes, said residue delimiting a pore, the wall of which is formed of the material of layer C and the bottom of which is formed by the material of substrate A.

By contrast, step 62 of the method disclosed in US '552 is directed to planarizing the plug layer 32 to the level of base layer 24 (see Figure 7 of US '552) and in polishing said plug layer 32.

Thus, at the end of step d) of the method of the present invention, the pores of the biomimetic membrane are nearly formed, whereas, at the end of step 62, of the method of US '552, the pores of the membrane are not at all formed.

Step e) of the method of the present invention is directed to liberating at least the part of layer B in which are found the pores formed in step d) by eliminating partially or totally substrate A, which allows to obtain the biomimetic membrane with nanometer scale pores.

By contrast, the method of US '552 still comprises four steps before obtaining a membrane with nanometer scale pores, namely steps 64, step 66, step 68 and step 70 which respectively are directed to:

depositing protective layers 34b and 34f on both sides of the wafer;
patterning and etching backside protective layer 34b and underlying substrate 20 to form an aperture;
selectively releasing protective layers 34b and 34f; and
in etching sacrificial base layer 28 and stop layer 22.

Thus, it should be clear that:

(1) The method of the present invention allows one to obtain a biomimetic membrane by only 5 steps whereas 11 steps are needed for obtaining a membrane with the method of US '552. Accordingly, the method of the invention is much easier to work and much more economically interesting than the method of US '552.

(2) The method of the present invention allows one to obtain a biomimetic membrane in which the wall of each hole is made by a single material, namely the material of layer C; by contrast, the wall of the holes of the membrane obtained in US '552, which is partially formed by base layer 24 and partially formed plug layer 32, may be composed of two different materials when, for example, base layer 24 is made of a low stress silicon nitride, whereas plug layer 32 is made of polysilicon. In such a case, the membrane is unable to be used as an experimental model in studies concerning biological membranes.

In view of the above, Applicants believe that the method of the present invention is both novel and unobvious over the disclosure of US '552.

Because neither US '648 nor US '900 rectify the deficiencies inherent to US '552, there can be no issue of obviousness over any combination of US '552, US '648, and US '900.

It is kindly requested that the Examiner acknowledge the same and withdraw these rejections.

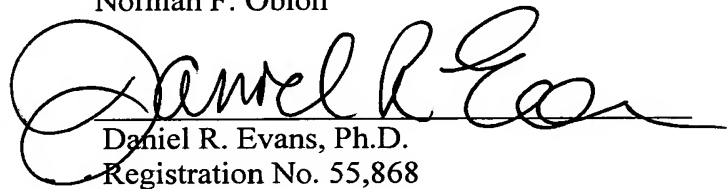
In view of the amendments to the claims and the comments contained herewith, it is believed that the present application is now in a condition for allowance. Should the Examiner deem that a personal or telephone interview would be helpful in advancing this application toward allowance, he is encouraged to contact Applicants' undersigned representative at the below-listed telephone number.

Respectfully submitted,

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